METHOD AND APPARATUS FOR INTRODUCING A ROADWAY SUPPORT

[0001] The invention relates, on one hand, to a method of introducing a roadway support in parallel to a face advancement of a gallery by means of a selective cut heading machine according to the features set forth in the preamble of claim 1.

[0002] On the other hand, the invention relates to an apparatus for carrying out the method according to the features set forth in the preamble of claim 1.

[0003] It is known in the prior art to carry out the face advancement of an underground gallery or tunnel with the aid of a selective cut heading machine independently of the support of this drifted gallery or this tunnel (DE-AS 23 61 227 or DE-PS 26 46 496).

[0004] The rate of advancement during drifting of a gallery with the use of a selective cut heading machine is determined predominantly by the supporting capability for arch support as well as for frame timbering. In this context, the real cutting power of a selective cut heading machine could not be fully exploited heretofore despite a parallelism of the cutting operation with the supporting operation. The travel and alignment of the selective cut heading machine is a reason that sequence-related not only the cutting operation but also the supporting operation has to be interrupted. Furthermore, the downtime of the selective cut heading machine is prolonged by the operation "lagging installation".

[0005] Starting from the prior art, the invention is based on the object to propose a method and an apparatus for introducing a roadway support in parallel to the face advancement of a gallery by means of a selective cut heading machine, by which the downtime of the selective cut heading machine is limited basically to maintenance and repair works.

[0006] With respect to the method, this object is attained by the characterizing features of claim 1.

[0007] The essence of the solution according to the invention resides in the fact that the lagging required for a reliable support of a gallery is introduced immediately behind the cutting tool of the selective cut heading machine and placed on the cleared rock quasi in the form of a protective envelope. In this way, the respective roadway support can then be introduced at a distance to the cutting tool while the lagging is secured.

[0008] Provided directly downstream of the cutting tool of the selective cut heading machine are hereby several lagging mats in the form of rolled mats which are arranged in two transverse planes extending behind one another in longitudinal heading direction. The rolled mats of each transverse plane are arranged in circumferential spaced-apart relationship in such a way that during unrolling the edges of the lagging mats in the 2nd transverse plane overlap the edges of the lagging mats of the 1st transverse plane which is closer to the drift face. In this way, the entire surface area of the gallery, cleared by the selective cut heading machine, is covered.

[0009] The overlap of the lagging mats in circumferential direction is so sized in accordance with the invention that a sufficiently large buffer is created at any time, when, e.g., geotechnical irregularities cause enlargement of the surface area and thereby trigger an unintended falling of loose rocks.

[0010] After unrolling of the lagging mats, which can have a length of about 20 m and widths of 1.5 m to 2 m for example, further lagging mats in the form of surface rolls again in circumferentially offset relationship in two transverse planes that follow one another in longitudinal heading direction are connected with the

previously laid lagging mats and immediately aligned at the surface area of the rock after being unrolled.

[0011] The invention then permits execution of the parallel supporting work with conventional arch support or frame timbering and complete backfilling with sprayed concrete or shotcrete for roof-bolting as well as with self-powered support units, like e.g. protective cover and formwork carriage, in the absence of any downtime of the selective cut heading machine during these supporting works.

[0012] It is especially advantageous in accordance with the features of claim 2 that the unrolled lagging mats are aligned upon the rock by a self-propelling lagging manipulator. This lagging manipulator provides a reliable positioning of the lagging mats upon the rock so that the respective roadway support can then easily be introduced.

[0013] The lagging manipulator may in addition be utilized in an advantageous manner to safeguard the cutting space above the cutting tool, when, for example, the selective cut heading machine must undergo scheduled maintenance or repair works.

[0014] According to the features of claim 3, it is of advantage to couple the ends of the previously laid lagging mats, which optionally may already be underpinned by a roadway support, with the ends of the newly unrolled lagging mats. Such a coupling can be realized only through overlapping or also through a direct joining of lagging mats that are arranged in succession in longitudinal heading direction.

[0015] According to the features of claim 4, the lagging mats may be fixed by roof bolting upon the rock.

[0016] It is also conceivable according to the features of claim 5 to securely fix the lagging mats in place by means of supporting frames (arch support, frame timbering).

[0017] Regardless whether a roof bolting or a roadway support with supporting frame is used, these support measures can be again carried out with working platforms which are movable independently of the selective cut heading machine in longitudinal heading direction.

[0018] With respect to the apparatus, the object of the invention is attained by the characterizing features of claim 6.

[0019] This apparatus according to the invention is characterized by a lagging manipulator which can be moved independently of the selective cut heading machine in longitudinal heading direction.

[0020] This lagging manipulator includes mat cartridges disposed in circumferentially offset relationship in two transverse planes extending behind one another in longitudinal heading direction for receiving the lagging mats in the form of rolled mats. The mat cartridges in a 1st transverse plane are hereby arranged at a gap to the mat cartridges of the other 2nd transverse plane.

[0021] The lagging manipulator follows immediately the cutting tool of the selective cut heading machine. The lagging mats unroll from the mat cartridges and are immediately aligned by the lagging manipulator on the cleared surface area of the rock. In this way, a circumferentially secured zone in the form of a protective envelope is created which can be used downstream of the lagging manipulator to correctly introduce the respective roadway support while the lagging mats are secured to the rock.

[0022] It is suitable in accordance with the features of claim 7 to provide the mat cartridges with self-adjusting restraining or tensioning mechanisms for the mat rollers.

[0023] In order to be able to correctly place and align the lagging mats upon the surface area of the rock, it is provided in accordance with claim 8, to provide the lagging manipulator with a height control. With the assistance of the height control, a certain distance of the lagging mats to the surface area of the rock can be realized during unrolling in the central length portion of each mat cartridge. As the lagging mats extend, e.g., during arch support in the form of a chord in relation to the surface area, an intentional biasing force is built up in concert with the restraining and tensioning mechanisms of each mat cartridge for the later introduction of the roadway support.

[0024] Associated to the height control are in accordance with claim 9 distance sensors in the form of, e.g., laser sensors. With the aid of these distance sensors, a technically feasible minimum distance can be reliably maintained between the lagging mats and the surface area of the rock.

[0025] When, in accordance with the features of claim 10, the lagging manipulator is moved along at least one overhead track, the height control is provided preferably upon a boom of the lagging manipulator.

[0026] According to claim 11, in a lagging manipulator which is guided on the gallery floor and/or drift wall, the distance of the rolled-off lagging mats in relation to the surface area of the rock can be realized in particular with hydraulically-operated cylinders.

[0027] An exemplified embodiment of the invention will subsequently be described in greater detail with reference to the drawings, in which:

[0028] Fig. 1 shows a schematic vertical longitudinal section of an underground gallery with an advancement and support system, shown also schematically;

[0029] Fig. 2 is a schematic perspective view of a lagging manipulator used during face advancement, viewed approximately in the direction of the arrow II of Fig. 1;

[0030] Fig. 3 shows a frontal view upon the lagging manipulator of Figs. 1 and 2, also viewed in the direction of the arrow II;

[0031] Fig. 4 is a schematic plan view upon the lagging manipulator of Figs. 1 to 3 according to the arrow IV of Fig. 3; and

[0032] Fig. 5 is a schematic vertical longitudinal section through the illustration of Fig. 4 along the line V-V as viewed in the direction of the arrows Va.

[0033] 1 designates in Fig. 1 an underground gallery which is drifted in the direction of the arrow Pf with the aid of a selective cut heading machine 2. Rocks separated from the drift face 4 by the cutting tool 3 of the selective cut heading machine 2 is transported away via a haulage conveyor 5 which is positioned upon the floor 6 of the gallery 1.

[0034] The gallery 1 is kept open by a roof bolting 7. The roof bolting 7 is introduced into the rock with the aid of a combined drilling and setting unit 8 which is operated from a vertically shiftable roof drilling platform 9. The roof drilling platform 9 is carried by a parallelogram boom 10 of a load-bearing overhead beam 11 which can travel along an overhead track 12.

[0035] In order to be able to execute setting of the roof bolting 7 at the same time as the tunneling of the gallery 1 takes place, a lagging manipulator 13 is provided directly behind the cutting tool 3 of the selective cut heading machine 2 and is suspended from the track 12 like the roof drilling platform 9 for movement along the track.

[0036] To maintain ease of illustration, a vertically swingable boom by which the lagging manipulator 13 is connected to a load-bearing overhead beam is not shown.

[0037] When jointly viewing Figs. 1 to 5, it can be seen that the lagging manipulator 13 includes mat cartridges 16, 17 which are arranged in two transverse planes 14, 15 extending behind one another in longitudinal heading direction. Lagging mats 18, 19 in the form of rolled mats 20, 21 are rolled up in these mat cartridges 16, 17. The mat cartridges 16, 17 are provided with self-adjusting restraining and tensioning mechanisms which are not shown in greater detail. In addition, the boom for the lagging manipulator 13 is equipped with a height control as well as distance sensors by which the distance of lagging mats 18, 19 to be introduced can be precisely set in relation to the cleared surface area 22 of the gallery 1.

[0038] The mat cartridges 16, 17 in each transverse plane 14, 15 are disposed offset in circumferential spaced-apart relationship. The mat cartridges 16 in the 1st transverse plane 14 adjacent to the drift face 4 are however placed at a gap to the mat cartridges 17 in the 2nd transverse plane 15.

[0039] The rolled mats 20, 21 in the mat cartridges 16, 17 can be unrolled with the aid of the shiftable lagging manipulator 13 in accordance with the face advancement along the surface area 22 and can hereby be aligned by the lagging manipulator 13 upon the surface area 22.

[0040] When the rolled mats 20, 21 are unwound, new rolled mats 20, 21 are placed in the mat cartridges 16, 17 and the ends of the lagging mats 18, 19 of the new rolled mats 20, 21 are coupled, preferably in overlapping relationship, with the adjacent ends of the laid lagging mats 18, 19.

List of Reference Characters

1 - gallery
2 - selective cut heading machine
3 - cutting tool of 2
4 - drift face
5 - gallery conveyor
6 - floor of 1
7 - roof bolting
8 - drilling and setting unit
9 - roof drilling platform
10 - boom
11 - load-bearing overhead beam
12 - track
13 - lagging manipulator
14 - 1st transverse plane
15 - 2nd transverse plane
16 - mat cartridge in 14
17 - mat cartridge in 15
18 - lagging mats
19 - lagging mats
20 - rolled mats in 16
21 - rolled mats in 17

Pf - arrow